A.I.A. File No. 19-F

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DFPA®
TESTED
QUALITY

FIR PLYWOOD

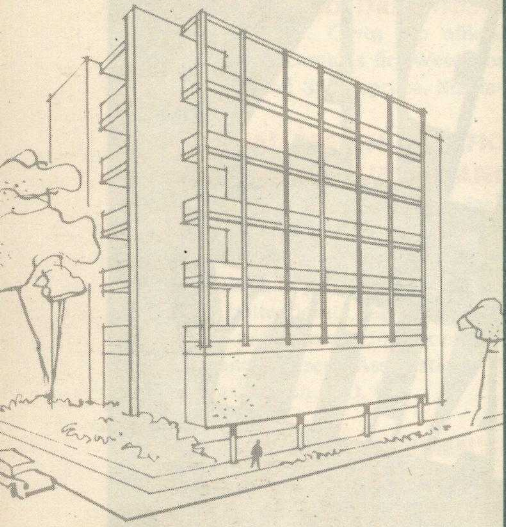
for today's construction

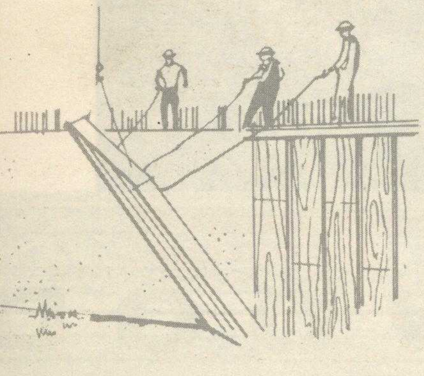
DOUGLAS FIR PLYWOOD ASSOCIATION

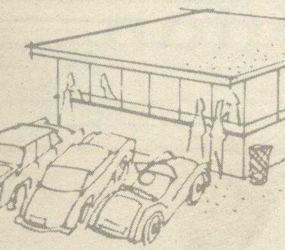
Tacoma 2, Washington

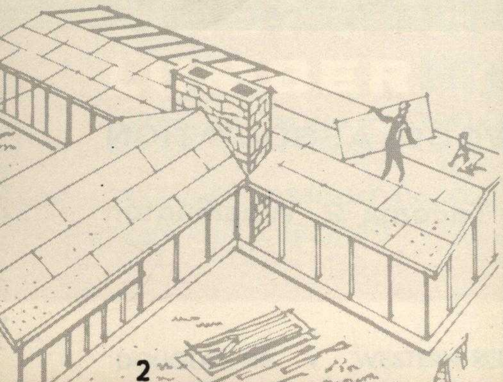
A.I.A. File No. 19-F

from Douglas fir come the finest plywood panels









Douglas Fir Plywood Association . . .

is a non-profit, industry-wide organization devoted to the research, promotion and quality control of fir plywood. It is supported by American manufacturers sharing a common interest in the manufacturing and marketing of Douglas fir and Western softwood plywoods.

product research · applied research

Besides maintaining a high level of quality in the production of fir plywood, DFPA also devotes much time and money to product and applied research. Continuous studies make possible new product developments and applications. This research supplies fresh data and new information for the applied technical manuals published by the Association. Close liaison is also maintained with building code officials, government agencies and research laboratories.

DFPA manufacturers are licensed

Through licensing, the industry maintains a rigid program of quality control centered about the DFPA owned grade-trademarks. These grade-trademarks provide positive identification that the panels bearing them have been inspected in accordance with the U. S. Commercial Standard and the rigid performance requirements of the Douglas Fir Plywood Association. Only then will the grade-trademark of the Association be applied to the product.

registered DFPA grade-trademarks appear on the back or edge of the panel. The letters "DFPA" indicate manufacture under the industry's rigid quality control program. Additional symbols designate the type and grade. The grade-trademarks are licensed for the members' use as long as the high standard of quality is maintained.

DFPA quality control program

Before being licensed to use DFPA grade-trademarks, every manufacturer participating in the Association's quality control program must pass rigid inspection and a testing of his current plywood production. The glues used must pass DFPA tests under actual manufacturing conditions.

Following this, the mills are inspected many times each month. Glue, equipment, veneers, lay-up and finished panels are carefully inspected at every vital stage of the manufacturing process. The inner plies, the ones you don't see, are especially examined for your protection.

Additional scientific testing of thousands of samples of current production in DFPA laboratories is further assurance of a quality product. A special check is made of the glue-line quality and durability.

quality products of DFPA members

definition

Douglas fir plywood, an engineered panel material, is made from a number of thin sheets of wood (veneers). Giant lathes peel select Douglas fir logs forming uniformly thick veneers. An odd number of veneers . . . three, five, seven or nine . . . are then securely bonded together with the grain of adjacent veneers at right angles to one another.

This cross-laminated construction distributes the along-the-grain strength of wood in both directions. Pound for pound, plywood is one of the strongest building materials known . . . even stronger than steel.

2 types

(determined by the glue bond used)

EXTERIOR type fir plywood is made with a completely waterproof glue. Its bond is stronger and more durable than the wood itself. Always use Exterior type plywood in those jobs exposed to heavy weather and moisture conditions.

®EXT-DFPA·A-A

INTERIOR type fir plywood is made with a highly moisture resistant, but not absolutely waterproof, glue. It works best in those applications where there is a limited exposure to weather and moisture.

®INT-DFPA·A-A

grades

(determined by the appearance quality of the veneers used)

A	Best standard veneer. Smooth and paintable. May be more than one piece, well jointed. Neatly made repairs permitted.
B	Solid surface veneer. Circular repair plugs and tight knots permitted.
C–	REPAIRED. Improved "C" veneer. Underlayment grade.
C	Minimum veneer permitted in Exterior type. Knotholes to 1", splits, plugs and other repairs permitted.
D	Used only for inner plys and backs of interior panels. Limited amount of white pocket permitted.
N	Special order "natural finish" veneer. Select, all heartwood. Free of open defects.

advantages

Large Size: Large, work-speeding sizes (4'x8' and larger) simplify construction and make possible time and labor savings of up to 50 and 75 per cent.

Light Weight: Plywood weighs far less than most metals, lumber and hardboard materials of equivalent strength. A 1/4" thick panel weighs about 8/10 of a pound per square foot.

Strength and Rigidity: The two-way strength offered in plywood construction is ideal for diaphragm construction, structural, bracing or plate-action applications.

Splitproof and Impact Resistant: Cross-laminated, plywood is splitproof and relatively punctureproof. This means high impact resistance.

Dimensionally Stable: Dry from the factory, plywood is never "green." Its cross-laminated construction restricts expansion and contraction within the individual plys. From oven-dry to complete saturation, a plywood panel shrinks or swells less than 2/10 of 1%.

Easy to Work: Plywood works quickly and easily with ordinary tools. It holds nails well and does not split when they are driven close to the edge. It glues well and will take any finish.

Low Cost: Economical to begin with, plywood further cuts costs because it lends itself to speedy fabrication. Exact panel sizes mean less waste.

western softwood plywood

Plywood panels are also manufactured from other Western softwoods. Available in Exterior and Interior types, they are made in various grades.

Each panel is manufactured under the DFPA's rigid Quality Control and testing program. Panels must meet or exceed the requirements of U. S. Commercial Standard CS 122-56.

Western larch, redwood, cedar, spruce, western hemlock, and noble and white fir are included in the various species used to manufacture Western Softwood plywood.

WSP

Additional information, or a copy of Commercial Standard CS 122-56 is available from DFPA on request.

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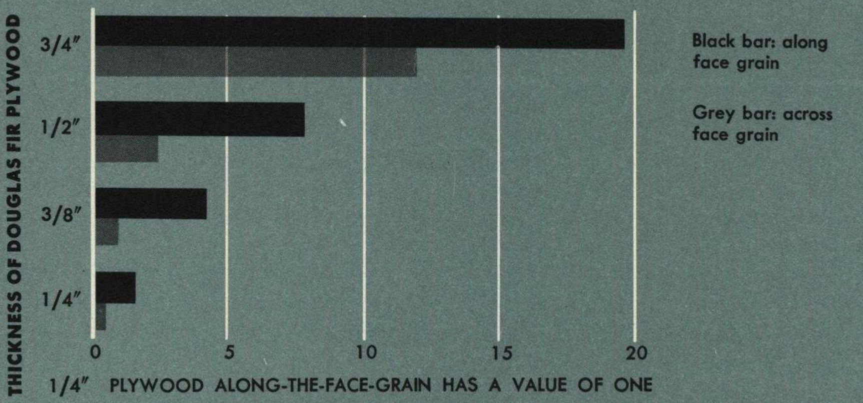
physical properties

relative stiffness

Relative plywood stiffness varies markedly with thickness and direction of face grain. Chart shows how various sanded plywood thicknesses compare in stiffness to 1/4" sanded plywood along-the-face grain, which equals value of 1 on the accompanying chart.



strength and rigidity

Two of the fundamental properties that make plywood a highly superior structural material are: large panel size and wood's strength parallel to the grain.

Plywood's cross-laminated construction provides two-way strength and rigidity in each panel. This construction makes plywood relatively split-proof, impact resistant and dimensionally stable.

Design properties for the various plywood thicknesses and constructions are available from DFPA on request.

STRENGTH AND RIGIDITY OF FRAME WALLS			RELATIVE RIGIDITY	RELATIVE STRENGTH
	1" x 8" DIAGONAL SHEATHING	(8d nails, 2 per stud crossing)	1.0	1.3
	25/32" FIBERBOARD	(8d nails, spaced 3" at all vertical edges, 5-1/2" to 6" elsewhere.)	1.6	2.1
	HORIZONTAL SHEATHING	(1 x 8 sheathing; 1 x 4 let in braces; 8d nails, 2 per stud crossing.)	1.5	2.2
	1/4" PLYWOOD NAILED	(6d nails spaced 5" at edges, 10" elsewhere.)	2.0	2.8
	1/4" PLYWOOD GLUED TO FRAME		3.7	4.0

Loads are applied laterally in the plane of the test panel.

The accompanying U.S. Forest Products Laboratory table illustrates plywood superiority in diaphragm construction.

nail bearing

Diaphragm action of plywood depends greatly on nail bearing for effectiveness. Plywood possesses this vital strength property to a high degree—even when nails are driven close to the panel edges.

NAIL BEARING LOADS TO FRAMING MEMBERS

Maximum ultimate loads to framing members for plywood nailed to 1 5/8" Douglas fir lumber. Plywood panels butted at center lines of studs or joints. Any reduction in edge distance will decrease loads applied perpendicular to the framing member, as in most shear panels. See "Technical Data Handbook" for additional information. These loads are ultimate and a suitable safety factor should be applied.

PLYWOOD THICKNESS	6d COMMON		8d COMMON		10d COMMON		16d COMMON	
	LOAD (lb. per nail)	PLYWOOD EDGE—DISTANCE	LOAD (lb. per nail)	PLYWOOD EDGE—DISTANCE	LOAD (lb. per nail)	PLYWOOD EDGE—DISTANCE	LOAD (lb. per nail)	PLYWOOD EDGE—DISTANCE
5/16"	275	3/8"	305	3/8"				
3/8"	275	3/8"	340	3/8"				
1/2"			350	3/8"	425	3/8"		
5/8"			350	3/8"	425	3/8"	445	3/8"
3/4"					410	3/8"	445	3/8"

MINIMUM BENDING RADII

PANEL THICKNESS	ACROSS GRAIN	PARALLEL TO GRAIN
1/4″	15″	24″
3/8″	36″	54″
1/2″	6′	8′
5/8″	8′	10′
3/4″	10′	12′

Average values for areas of clear, straight grain.

VAPOR TRANSMISSION

PLYWOOD THICKNESS	TYPE	FINISH	WATER VAPOR TRANSMISSION IN GRAINS/HOUR SQ. FT./IN. HG.
1/4″	Int.	Untreated	1.86
1/4″	Int.	1 thin undercoat, 1 coat shellac	0.77
1/4″	Int.	2 coats flat interior paint	1.06
5/16″	Int.	(Sheathing), untreated	1.80
3/8″	Ext.	(3 coats) 1 Standard primer or aluminum primer 2. Two coats of outside paint	0.19
3/8″	Ext.	Untreated	0.72

SOUND INSULATION

1/4″ PLYWOOD	SOUND TRANSMISSION LOSS IN DECIBELS
Single Sheet	22.4
Both sides of 2 x 4 studs	31.3

SOUND ABSORPTION

1/4″ PLYWOOD	FREQUENCY CYCLES					
	128	256	512	1024	2048	Avg.
Both sides of 2 x 4 studs	.31	.11	.14	.12	.10	.16

PANEL CONSTRUCTION

PLYWOOD INNER LINING	INSULATION BETWEEN STUDS	PLYWOOD OUTER WALL	"U" VALUES*
3/8″ Plywood (Single sheet)			.79
3/4″ Plywood (Single sheet)			.58
1/4″	None	3/8″ Ext.	.40
1/4″	1/2″ Blanket	3/8″ Ext.	.19

*Coefficient of thermal transmission in B.T.U.'s/hr./sq.ft./° Temp. diff.

bending

Simple curves are easy to form with plywood. Best results are obtained when a continuous rounded backing is used. In applications where there are abrupt curvatures secure the panel end to the shorter radius first. In critical bends, two thin panels often work better than one thick one. Shorter radii can be developed by wetting and steaming . . . use only Exterior-type plywood . . . however, there is a greater risk of rupture, checking and grain raise with this method.

vapor transmission

The tabular values represent the water vapor transmitted through plywood in grains per square foot, per hour, per inch of mercury pressure.
Values less than 1.00 are regarded as indicating an efficient vapor barrier material. The lower the value, the more effective the barrier.

acoustical

In absorbing sound and reducing its transmission, plywood rates well. The tabulated values show the loss of sound transmitted through plywood panels. Sound absorption coefficients are also shown on the chart.

thermal

Plywood like any wood has excellent insulating properties. A $\frac{5}{16}$″ thick panel plus a dead air space has the same insulation value as $\frac{7}{16}$″ of "insulation" material. Plywood panelled walls with backing at all joints prevent drafts and air infiltration and create true dead air spaces.

types / grades / typical uses / sizes

types

- **EXTERIOR**
- **INTERIOR**
- **SPECIAL**

grades

A

Best standard veneer. Smooth and paintable. May be more than one piece, well jointed. Neatly made repairs permitted.

B

Solid surface veneer. Circular repair plugs and tight knots permitted.

C REPAIRED

Improved "C" veneer. Underlayment grade.

C

Minimum veneer, permitted in Exterior type. Knotholes to 1", splits, plugs and other repairs permitted.

D

Used only for inner plys and the backs of interior panels. Limited amount of white pocket permitted.

N

Special order "natural finish" veneer. Select, all heartwood. Free of open defects.

	GRADE	GRADE-TRADEMARK EDGEBRAND	BACKSTAMP	DESCRIPTION AND USES
EXTERIOR TYPES	A-A	EXT-DFPA·A-A		Used where the appearance of both sides is important. Fences, carports, signs, boats, etc.
	A-B	EXT-DFPA·A-B		For uses similar to EXT A-A panels, but where the appearance of one side is less important.
	A-C	EXT-DFPA·A-C	EXT-DFPA A-C DOUGLAS FIR CS 45-55 DFPA TESTED QUALITY	Exterior plywood with a waterproof bond. Used where the appearance of only one side is important.
	B-C	EXT-DFPA·B-C	EXT-DFPA B-C DOUGLAS FIR SPECIAL DFPA TESTED QUALITY	An outdoor utility panel. For farm and work buildings.
	C REP C	EXT-DFPA·C REP C	EXT-DFPA C REP C DOUGLAS FIR CS 45-55 DFPA TESTED QUALITY	Used as a base for tile, linoleum, carpeting, where unusual moisture conditions exist.
	C-C	EXT-DFPA·C-C	EXT-DFPA C-C DOUGLAS FIR CS 45-55 DFPA TESTED QUALITY	Unsanded grade with waterproof bond. Best for backing, rough construction, farm buildings, etc.
	B-B PLYFORM	EXT-DFPA·PLYFORM	PLYFORM EXT-DFPA B-B DOUGLAS FIR CS 45-55 DFPA TESTED QUALITY	Concrete form grade, maximum re-use. Edge sealed with distinctive red sealer. Mill oiled unless otherwise specified.
INTERIOR TYPES	A-A	INT-DFPA·A-A		For interior applications where both sides will be viewed.
	A-B	INT-DFPA·A-B		For use similar to INT. A-A panels, but where the appearance of one side is less important.
	A-D		INT-DFPA A-D DOUGLAS FIR CS 45-55 DFPA TESTED QUALITY	Interior use where appearance of only one side is important.
	B-B		INT-DFPA B-B DOUGLAS FIR CS 45-55 DFPA TESTED QUALITY	Utility panel. Used where two smooth sides are required.
	B-D	INT-DFPA·B-D	INT-DFPA B-D DOUGLAS FIR CS 45-55 DFPA TESTED QUALITY	Utility panel. Used where one smooth side is required.
	C REP D		STRUC-INT C REP D DOUGLAS FIR CS 45-55 DFPA TESTED QUALITY	Base for tile, linoleum, carpeting, and backing material for interior use.
	PLYSCORD		PLYSCORD STRUC-INT C-D DOUGLAS FIR CS 45-55 DFPA TESTED QUALITY	Unsanded sheathing or structural grade fir plywood.
	PLYSCORD exterior glue		PLYSCORD STRUC-INT C-D DOUGLAS FIR CS 45-55 EXTERIOR GLUE DFPA TESTED QUALITY	Same as PlyScord above, but with waterproof glue. Not normally a substitute for Exterior grade plywood.
	B-B PLYFORM		PLYFORM STRUC-INT B-B DOUGLAS FIR CS 45-55 DFPA TESTED QUALITY	Re-usable concrete form plywood. Glue moisture-resistant, not waterproof. Green sealed edges, mill oiled unless otherwise specified.
	2-4-1		2·4·1 STRUC-INT DOUGLAS FIR DFPA TESTED QUALITY	New combination subfloor and underlayment. Base for tile, linoleum, carpeting, and wood strip flooring. Used on 4' spans.

PLYSCORD ·00
STRUC-INT C-D
WSP 1
CS 122-56
DFPA TESTED QUALITY

◀ For ordinary sheathing applications, Western Softwood Plywood panels bearing the PlyScord grade trademark at left may also be specified.

FACE	BACK	INNER PLIES	WIDTH	LENGTH	THICKNESS 1/4″	5/16″	3/8″	1/2″	5/8″	3/4″	1″
A	A	C	4′	8′	●		●	●	●	●	●
A	B	C	4′	8′	●		●	●	●	●	●
A	C	C	4′	8′	●		●	●	●	●	●
B	C	C	4′	8′	●		●	●	●	●	
C REPAIRED	C	C	4′	8′	●		●	●	●	●	
C	C	C	4′	8′		●	●	●	●	●	
B	B	C	4′	8′					●	●	
A	A	D	3′-4′	8′	●		●	●	●	●	
A	B	D	3′-4′	8′	●		●	●	●	●	
A	D	D	3′-4′	8′	●		●	●	●	●	
B	B	D	4′	8′	●		●	●	●	●	
B	D	D	4′	8′	●		●	●	●	●	
C REPAIRED	D	D PLY NEXT TO FACE C OR BETTER	4′	8′	●		●	●	●	●	
C	D	D	4′	8′		●	●	●	●	●	
C	D	D	4′	8′		●	●	●	●	●	
B	B	C	4′	8′					●	●	
C REPAIRED	D	D	4′	8′	7 PLY 1 1/8″ ONLY						

Panels 3/8″ and thinner have minimum of 3 plys; 1/2″ to 3/4″ inclusive are 5-ply minimum; thicker panels have 7-ply minimum. If more plys per thickness are desired they may be had on special order. Also available are king size panels (12′, 14′, 16′, 20′ and longer).

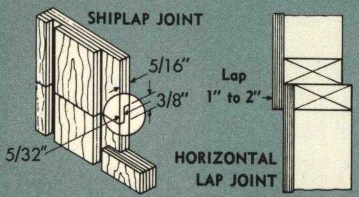
special products

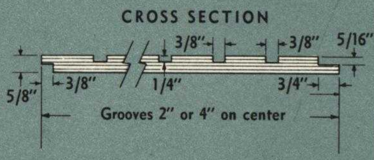
- **special surface patterns**
- **overlaid panels**
- **special items**

KIND	GRADE-TRADEMARK EDGEBRAND	BACKSTAMP	DESCRIPTION
TEXTURE ONE-ELEVEN EXTERIOR	TEXTURE I-II · EXT-DFPA	TEXTURE ONE-ELEVEN EXT-DFPA DOUGLAS FIR DFPA TESTED QUALITY	Exterior type with parallel grooves ¼" deep, ⅜" wide. Unsanded, shiplapped edges.
BRUSHED, EMBOSSED AND STRIATED EXTERIOR-INTERIOR	® EXT-DFPA ® INT-DFPA		Grain of panel face accented to give depth and dimension. Both Exterior and Interior-types.
MEDIUM-DENSITY OVERLAID PLYWOOD EXTERIOR	® EXT-DFPA		Exterior type plywood with a smooth, hard, fused-resin fiber overlay.
HIGH-DENSITY OVERLAID PLYWOOD EXTERIOR	® EXT-DFPA		Exterior plywood with hard translucent fused-resin fiber overlay. Slight grain pattern. Abrasion resistant.
PLYRON® EXTERIOR-INTERIOR	® EXT-DFPA · PLYRON ® INT-DFPA · PLYRON		Hardboard faced one or both sides. Available in Interior or Exterior types.
NATURAL FINISH N-D INTERIOR	® INT-DFPA · N-D	INT-DFPA N-D ® DOUGLAS FIR CS 45-55 DFPA TESTED QUALITY	Cabinet quality. One special side select, all heartwood veneer. Solid core construction.
NATURAL FINISH N-N INTERIOR	® INT-DFPA · N-N		Cabinet quality. Both sides select, all heartwood veneer. Special solid core construction.
MARINE EXTERIOR	® ⚓ · MARINE · EXT-DFPA · ⚓		Exterior-type panels. Special solid core construction for marine use. Available also in overlay grades.

special surface patterns

TEXTURE ONE-ELEVEN





Texture One-Eleven panels have deep parallel grooves cut in the face to create a rhythmic, stylized design effect. All panels are made with 100% waterproof glue, and bear the EXT-DFPA grade trademark. Surface is slightly rough (unsanded) and contains small knot holes and other natural wood characteristics. Weathering will produce small checks. However, properly finished these blend into the natural beauty of the panel. All plys in standard Texture One-Eleven are of Douglas Fir (also available in sanded faces and other western soft woods from some producers.) Standard Texture One-Eleven also permits tight knots up to 1½"; knot holes up to 1" in least dimension; splits up to ⅛". Faces are free from patches or tape. Backs are not grooved. Edges are rabbeted to form continuous pattern without evidence of joints.

Nailing: Use 8d galvanized casing nails. Drive flush but do not set. When nails are 4" o.c. along all four edges and 8" o.c. on intermediate studs neither sheathing nor diagonal bracing is needed.

Finishing: For any outdoor use the recommended finish is a highly pigmented exterior stain. For interior use almost any paint or stain finish may be used for either single or multi-tone effects.

USES	WIDTH	LENGTH	THICKNESS 1/4″	5/16″	3/8″	1/2″	5/8″	3/4″
Siding, gable ends, patio fences, interior paneling or where textured accents are desired.	16″ 32″, 48″	8′, 10′					●	
Textured paneling, built-ins, counter facings, displays. For siding and gable ends use Exterior-type only.	4′	8′		●	●			
Especially surfaced for painting. Exterior siding, soffits, etc. Kitchen cabinets and signs.	12″, 16″ 24″, 48″	8′			●	●	●	●
Concrete form work, signs, cabinets. Industrial uses.	4′	8′			●	●	●	●
Concrete forms, counter tops, shelving, cabinet doors and built-ins.	4′	8′				●	●	●
Furniture having a natural finish. Cabinet doors, paneling, built-ins.	4′	8′	●					
Furniture having a natural finish. Cabinet doors, paneling, built-ins.	4′	8′					●	
Boat hulls, cabins and other marine application.	4′	8′ ALSO LONG LENGTHS	●	●	●	●	●	●

Panels 3/8″ and thinner have a minimum of 3 plys; 1/2″ to 3/4″ inclusive are 5-ply minimum; thicker panels have 7-ply minimum. If more plys per thickness are desired they are available on special order.

Medium density and high density overlaid plywood panels are also available in longer lengths on special order.

BRUSHED, EMBOSSED AND STRIATED

Brushed

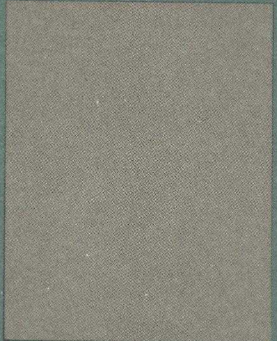
Embossed

Striated

decorative surfaces: Handsome decorative surfaced plywood panels are available in grooved, brushed, embossed or striated patterns.

overlaid panels

High density overlay


Medium density overlay

medium density overlaid fir plywood is Exterior type plywood with a resin impregnated fiber added to one or both sides of the panel. Its surface has been especially developed as a superior paint base.

high density overlaid fir plywood is Exterior type plywood with a resin impregnated fiber added to both sides of the panel. Highly abrasion resistant, its surface is impervious to moisture penetration or absorption, making it ideal for a variety of applications.

For additional information write DFPA,
Tacoma 2, Washington

data / requirements / working / finishing

floors*

In floor construction fir plywood can be used to advantage in 3 separate applications. (1) subflooring, (2) underlayment, (3) combined subflooring and underlayment.

walls*

For extra strength and rigidity without corner bracing, use PlyScord, the unsanded sheathing grade. If unusual moisture conditions exist, use EXT-DFPA C-C Grade.

roofs*

Firm, solid roof decks that hold nails well are possible with fir plywood. PlyScord or PlyScord with Exterior glue are the recommended grades. When the edges of the roof are directly exposed to the weather, such as at the eaves, use a starter strip of Exterior fir plywood.

building codes*

For more than 20 years, the Uniform Building Code has accepted fir plywood. The Building Officials Conference of America Code, the Southern Building Code and many other individual city, county and state codes also accept fir plywood.

*Additional construction data is available in the DFPA Construction Guide.

PLYWOOD THICKNESSES, SPANS AND NAILING RECOMMENDATIONS
(Plywood Continuous Over 2 or More Spans; Grain of Face Plys Across Supports)

Application	Recommended Thickness	Max. Spacing of Supports (C. to C.)	Nail Size and Type	Nail Spacing	
				Panel Edges	Intermediate
Subflooring or Subfloor Underlay	1/2″ (a)	16″ (b)	6d Common (c)	6″	10″
	5/8″ (a)	20″	8d Common (c)	6″	10″
	3/4″ (a)	24″	8d Common (c)	6″	10″
	2.4.1. (a)	48″	8d Ring Shank (c)	6″	6″
Underlayment	3/8″ (d)		6d Ring Shank or Cement Coated F.H.	6″	8″ Each Way
	5/8″		8d Ring Shank or Cement Coated F.H.	6″	8″ Each Way

If supports are not well seasoned, use ring-shank nails.

(a) Provide blocking at panel edges for carpet, tile, linoleum or other non-structural flooring. No blocking required for 25/32″ strip flooring.
(b) If strip flooring is perpendicular to supports 1/2″ can be used on 24″ span.
(c) If resilient flooring is to be applied without underlayment, set nails 1/16″.
(d) FHA accepts 1/4″ plywood.

PLYWOOD THICKNESS, SPANS AND NAILING RECOMMENDATIONS

Application	Recommended Thickness	Max. Spacing of Supports (C. to C.)	Nail Size and Type	Nail Spacing	
				Panel Edges	Intermediate
Sheathing	5/16″	16″ (a)	6d Common	6″	12″
	3/8″ - 1/2″	24″	6d Common	6″	12″
	5/8″	24″	8d Common	6″	12″
Panel Siding	3/8″	16″	6d Box or Casing (b)	6″	12″
	1/2″ or Thicker	24″	8d Box or Casing (b)	6″	12″
Lap Siding or Bevel Siding	3/8″		6d Box or Casing (b)	One nail per stud along bottom edge and 4″ at vertical joints.	8″ vertical spacing on intermediate studs.
	1/2″ or Thicker		8d Box or Casing (b)		

(a) Apply with face grain perpendicular to supports for maximum strength and stiffness.

(b) Use non-corrosive (hot-dipped galvanized or aluminum) nails.

PLYWOOD THICKNESS, SPANS AND NAILING RECOMMENDATIONS
(Plywood Continuous Over 2 or More Spans; Grain of Face Plys Across Supports)

Plywood Thickness	MAXIMUM SPACING OF SUPPORTS (C. to C.) (Total Roof Load, Pounds Per Square Foot)				NAIL SIZE AND TYPE	NAIL SPACING	
	20	30	40	50		Panel Edges (when over framing)	Intermediate
5/16″ Rough	20″ (a)	20″	20″	19″	6d Common	6″	12″
3/8″ Rough	24″ (a)	24″	24″	23″	6d Common	6″	12″
1/2″ (b) Rough	32″ (a)	32″	30″	29″	6d Common	6″	12″
5/8″ (b) Rough	42″ (a)	42″	39″	36″	8d Common	6″	12″
3/4″ (b) Sanded or Rough	48″ (a)	47″	42″	39″	8d Common	6″	12″
13/16″ (b) Rough	60″ (a)	53″	48″	45″	8d Common	6″	6″

(a) These spans shall not be exceeded for any load condition.
(b) Provide adequate blocking, or suitable edge support, such as Plyclips, when span exceeds 28″ for 1/2″, 32″ for 5/8″, 36″ for 3/4″ and 40″ for 13/16″.

For special case of plywood continuous over 2 spans only, spans may be increased 6-1/2%, except as limited by foot note (a) above, or loads may be increased 20% for the same span.

FHA requirements*

When the minimum property standards of the FHA are met for each use, this agency allows the use of plywood in all parts of the home. This table sets out the basic FHA requirements.

floors MINIMUM THICKNESSES, SPANS AND NAILING SCHEDULES

(Grain of Face Plys Across Supports; Stagger All Panel End Joints)

APPLICATION	MINIMUM THICKNESS	MAXIMUM JOIST SPACING (C-C)		NAIL SIZE AND TYPE	NAIL SPACING	
		Wood Strip Flooring	Wood Block or (a), Resilient Flooring		Panel Edges	Intermediate
Subflooring	1/2"	16" (b)	16"	8d Common or 6d Threaded	6"	10"
	5/8"	20" (b)	20"	8d Common or 6d Threaded	6"	10"
	3/4"	24"	24"	8d Common or 6d Threaded	6"	10"
Underlayment	1/4"			6d Ring Shank or Cement Coated F. H.	6"	8" Each Way

(a) Solid blocking shall be installed under all edges at right angles to joist except when a separate underlayment material is installed over subfloor.

(b) May be 24 inches o. c. if 25/32 inch wood strip flooring is installed at right angles to joists.

walls MINIMUM THICKNESSES, SPANS AND NAILING SCHEDULES

APPLICATION	MINIMUM THICKNESS	MAXIMUM STUD SPACING (C-C)	NAIL SIZE AND TYPE	NAIL SPACING	
				Panel Edges	Intermediate
Sheathing	5/16"	16"	6d Common	6"	12"
	3/8"	24"	6d Common	6"	12"
Panel Siding Over Sheathing	1/4"	24" (c)	Corrosion Resistant 1" Stud Penetration	6"	12"
Panel Siding No Sheathing	3/8"	16"	Corrosion Resistant 1-1/2" Stud Penetration	6"	12"
	1/2"	24"			
Lap Siding (a) Over Sheathing	1/4"	24" (c)	Corrosion Resistant 1" Stud Penetration	If siding is wider than 12", add nail to stud at center of piece.	
Lap Siding (b) No Sheathing	3/8"	16"	Corrosion Resistant 1-1/2" Stud Penetration		
	1/2"	24"			
Soffits, Carports, Porches, etc.	1/4"	16"	Corrosion Resistant 1-1/2" Support Penetration	6"	12"
	3/8"	24"			
Interior Walls and Ceilings	1/4"	16"	11 to 12 Gauge Casing or Finishing Nails 3/4" Support Penetration	6" on Ceiling 8" on Walls	
	3/8"	24"			

(a) Minimum headlap:
(1) Width, 12 inches or less, 1 inch.
(2) Width, over 12 inches, 1½ inches.

(b) Minimum headlap, 2 inches.

(c) Except when sheathing or interior finish requires lesser spacing.

roofs MINIMUM THICKNESSES, SPANS AND NAILING SCHEDULES

(Grain of Face Plys Across Supports; Stagger All Panel End Joints)

PLYWOOD THICKNESS	MAXIMUM SUPPORT SPACING (C-C)					NAIL SIZE AND TYPE	NAIL SPACING	
	Asphalt or Wood Shingles or Shakes		Built-up Roofing (a)		Slate, Clay Tile or Asbestos-Cem. Shingles			
	Blocked (b)	Unblocked	Blocked (b)	Unblocked	Unblocked		Panel Edges	Intermediate
5/16"	16"	16"	16"	..	..	6d Common (c)	6"	12"
3/8"	24"	20"	24"	16"	..	6d Common (c)	6"	12"
1/2"	32"	24"	32"	20"	16"	8d Common (c)	6"	12"
5/8"	42"	28"	42"	24"	24"	8d Common (c)	6"	12"
3/4"	48"	32"	48"	28"	32"	8d Common (c)	6"	12"

(a) Flat roofs used for walking traffic such as sun decks shall use same construction as subflooring.

(b) Blocking of edges shall be by accurately cut wood blocking or by extruded aluminum clip designed for this purpose.

(c) Or 5d threaded nails for 5/16" and 3/8" plywood and 7d threaded nails for other thicknesses.

working and finishing

Cutting For most work a 10-point cross-cut saw works best. For curves, use a sharp, fine-toothed coping saw. In power saws, a combination blade filed with less than normal hook is ideal. Set the blade to protrude through the panel ½" or less.

Drilling When drilling plywood, use a 120° point for a smooth hole. Machine bits are satisfactory. A wood chip breaker is recommended.

Fastening Plywood holds nails well. They can be placed near the edges without fear of the panel splitting. Spiral or ring-shanked nails give extra holding power. Screws, bolts and other special fastenings may be used. Pre-drill screw holes, and countersink with caution. Washers give bolts a bearing surface.

Gluing Panel edges and faces may be glued. Proper gluing techniques will increase strength and rigidity and make the glue joints stronger than the wood itself. For exterior applications a resorcinal or phenolic type glue is recommended. Follow the glue manufacturer's directions. Nails or screws can be used to maintain pressure.

Finishing Paint plywood as you would regular wood. Top grade exterior house paints (TLZ or white lead and oil base) give excellent service. Stains do not provide a protective film and checking may be expected. Seal all panel edges with a heavy coat of exterior primer. Prime the panel backs in unusually damp localities.

*Write DFPA for complete details on how to buy, finish and work fir plywood.

components structural systems

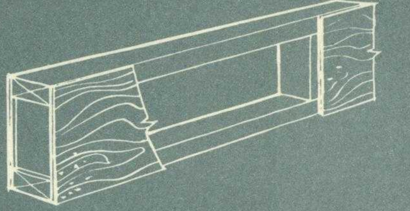
components

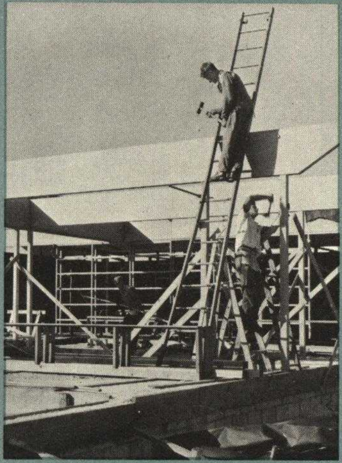
Component construction is one of today's newest construction techniques. It eliminates the necessity of erecting a building board by board, panel by panel, and nail by nail.

Now buildings are assembled fabricated unit by fabricated unit, and components of fir plywood are being used everywhere—even in high priced custom homes.

But plywood components are not really new. DFPA has researched their design and fabricating techniques since 1938. Gusset plates, stressed skin and sandwich panels, box beams, and curved panels of plywood have been studied. Roof, flooring and other similar structural systems have also been studied, and they will be available to you soon.

box beams

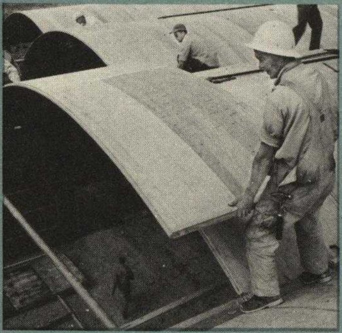


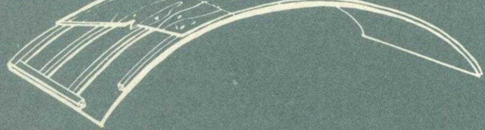


A highly versatile component spanning distances up to 120 ft., box beams utilize the structural soundness and inherent physical properties of plywood to achieve new and economical building concepts.

They consist of one or more vertical plywood webs laminated to seasoned lumber flanges. Vertical lumber spacers separate the flanges at intervals along the beams length to distribute the concentrated loads and prevent web buckling.

curved panels





A "natural" for contemporary roofs, the arching action of these panels permits spanning great distances with a relatively thin cross section.

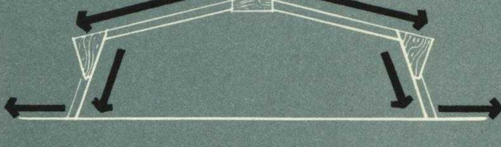
High in esthetic value they are available in three types: the sandwich or honeycombed paper core panel, the hollow stressed skin panel, and the solid core.

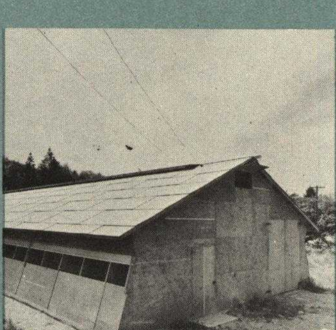
structural systems

DFPA's structural systems research has also included the rigid frames and folded plate roofs shown here.

The techniques developed in these structural systems is the result of DFPA's long experience in engineering research, quality control and product testing for the plywood industry.

rigid frames



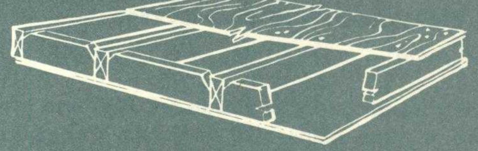


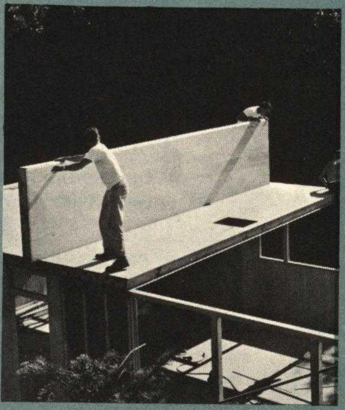
Rigid frame construction is ideal in warehouses, farm buildings, and other similar light construction.

Clear spans of 50 ft. and more are possible with the added advantage of openness and plenty of head room.

The individual frames are easy to construct for they have a minimum number of parts. Unlike other components they require no gluing.

stressed skin panels



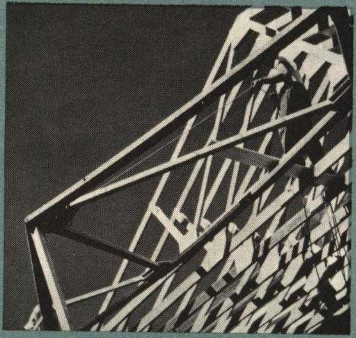


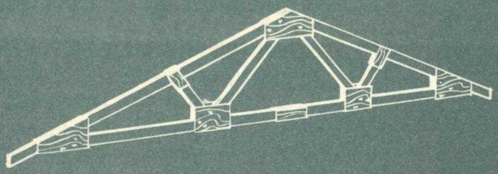
Most adaptable of the modern building components, are the stressed skin panels. They are used in floors, walls, and roofs, and as computer platforms or pallets in industry.

Rectangular in shape they are constructed of plywood and seasoned lumber. The simple framing and plywood skins act as a unit to resist loads.

Glue joints transmit the shear stresses making it possible for the structure to act as one.

trusses





Oldest among components is the truss. Its development made open room construction a reality. And because a truss is only as good as the joints which fasten it together, fir plywood gusseted trusses are best.

When plywood gusset plates are used on both sides of a joint, they eliminate eccentricity which tends to cause twisting.

advantages

Fir plywood components offer many advantages:

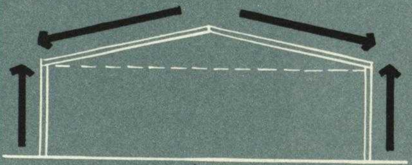
- Reduced in-place costs
- Quality construction
- Uniform manufacture
- Modular construction
- Precision fit
- Select materials
- Design freedom
- Simple construction
- Attractive appearance
- Rapid delivery

To fill the need for quality controlled components in the construction industry, DFPA established Plywood Fabricator Service, Incorporated, a non-profit affiliate organization. It is devoted to the independent, impartial quality control of components for the fabrication industry. Pilot programs are now being inaugurated.

For detailed information write:

Douglas Fir Plywood Association
1119 A Street
Tacoma 2, Washington
Attention Department S-60

folded plate roofs



Folded plate roofs are thin skins of fir plywood reinforced by purlins to form shell structures that can utilize the high reserve diaphragm strength of plywood.

They eliminate trusses and other such members. The tilted planes lean against one another acting as giant "V" shaped beams supported by walls or columns. Large buildings such as schools, warehouses, and stores are typical uses for this roofing method.

design data

Additional design data for these structural systems is available from the Technical Department, Douglas Fir Plywood Association, Tacoma 2, Washington.

When writing please request the laboratory report on: Design Method for Plywood Folded Plate Roofs.

Plans for Rigid Frame Structures Spanning 32 and 40 ft. are available from DFPA.

concrete forms

fir plywood forms permit greater freedom in the design of concrete structures

Fir plywood concrete forms first made it possible to economically use concrete in architectural design. No other development in the construction field has been more widely or quickly adopted and used.

This universal form material has reduced costs and offered greater design freedom as the result of rigid industry standards that control the manufacture of PlyForm and Overlaid plywood. Extensive laboratory and field tests as well as surveys among architects, engineers and contractors helped establish these standards.

interior and exterior PlyForm
high density overlaid
fir plywood

allowable support spacing ⟶

(Basis for the preparation of charts)

Support spacings for the various thicknesses of PlyForm panels continuous across two or more spans with their face grain perpendicular* to the supports are shown in the chart.

When spans exceed 10″, 12″ and 14″ for ½″, ⅝″ and ¾″ plywoods respectively, the spacing is limited by an allowable deflection of 1/270th of the span. If the spans are less, the spacing is limited by a permissible stress of 2000 p.s.i. The stress in bending for dry PlyForm, which is 1875 p.s.i., has been reduced one-fifth for the effect of wetting and increased one-third for short-time loading. Additional consideration has also been given to moisture conditions by reducing the stiffness value 20%.

*special conditions

When the face grain is parallel with the supports apply the following percentages:

For ½″ thickness, use 40% of load on chart;
For ⅝″ thickness, use 51% of load on chart;
For ¾″ thickness, use 73% of load on chart;
For any given span and allowable deflection.

When panels are used on a single span, stiffness is only half that shown on chart.

concrete form framing lumber working stress (1)

Kind and Grade	Extreme Fiber in Bending	Compression Perpendicular to Grain	Compression Parallel to Grain L/d ≦ 10	Horizontal Shear	Modulus of Elasticity
Coast Region Douglas Fir Const.	1500	390	1200	120	1,760,000
Douglas Fir Standard	1200	390	1000	95	1,760,000
Southern Pine No. 1	1500	390	1350	120	1,760,000
Southern Pine No. 2	1200	390	900	105	1,760,000
West Coast Hemlock Const.	1500	365	1100	100	1,540,000
Eastern Spruce—1200f	1200	300	900	95	1,320,000

(1) Working stresses (except Modulus of Elasticity) may be increased up to ⅓ over these tabulated values when load is of short duration, such as the time required for concrete to set. (Data from National Lumber Manufacturers Association.)

suggested concrete design pressures lbs. per sq. ft.*

Rate of Pour Ft./hr.	VIBRATED		UNVIBRATED	
	at 50° F.	at 70° F.	at 50° F.	at 70° F.
2	650	550	450	350
3	900	650	600	450
4	1050	750	750	550
5	1200	900	900	650
6	1350	1050	1050	750
7		1200	1200	850
8		1350	1350	950
9				1050

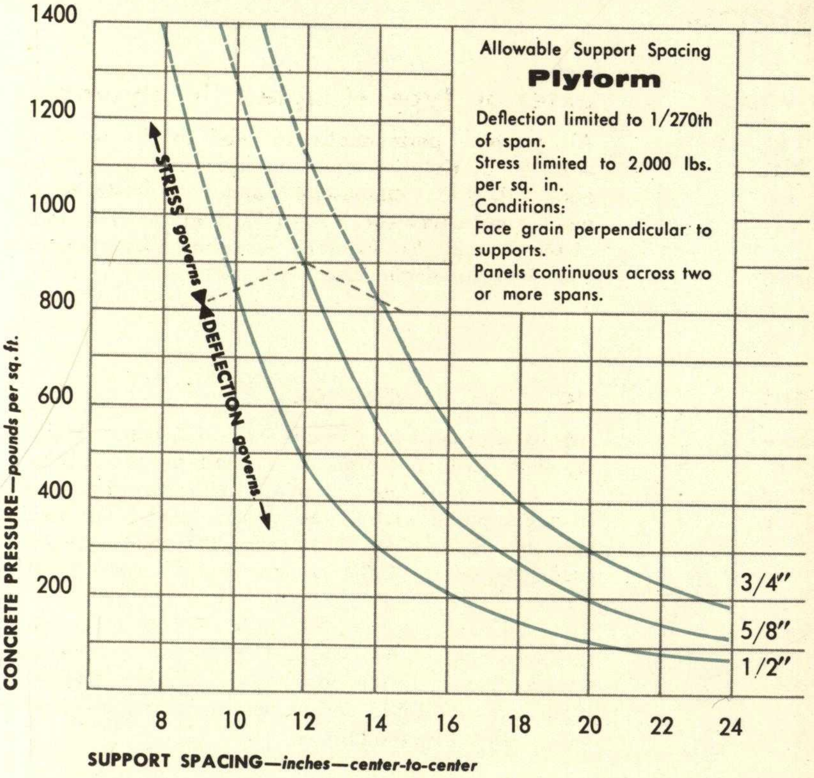
Depth-D; at Maximum Pressure-P;

A. Vibrated $D = \frac{P}{150}$ B. Unvibrated $D = 2 + \frac{P}{150}$

NOTE: In case form height is less than D (Depth at Maximum Pressure), design pressure may be reduced by proportion of form height to D. For example, with a 5′ high wall poured with unvibrated concrete at 70° at 6′/hr., Maximum Pressure is 750 psf, and $D = 2 + \frac{750}{150} = 7'$

Then design pressure would be $\frac{5' \times 750}{7'} = 536$ psf.

*Test data indicate much variation in concrete pressures. The above values are suggested where better data are lacking. They are taken from "Design Assumptions for the New Keely PlyForm Calculator," by M. L. Elkins, Registered Professional Engineer, and include data furnished by the Universal Form Clamp Co. for vibrated concrete.



how to use this graph

In many cases other deflection limitations and stresses are required. They can be determined by taking an appropriate proportion of the concrete pressure. For example:

CONDITION: A minimum deflection of 1/360th the span length is required and ¾″ PlyForm on 18″ centers is being considered.

PROBLEM: Determine the effective concrete pressure and the correct support spacing for this allowable deflection.

SOLUTION:

Step 1. Enter the graph with known factors and determine, from the curve, the allowable pressure for a 1/270th span using ¾″ plywood on 18″ centers. It is 400 psf.

Step 2. Deflection varies in proportion to the pressure, therefore:

$$\frac{270}{400} = \frac{360}{X} = 533 \qquad \therefore X = 533 \text{ psf effective pressure.}$$

Step 3. Re-enter the graph and select the correct support spacing for ¾″ plywood under a 533 psf pressure. It is: 16″ on centers.

Strictly speaking, adjustments should be made only on that part of the curve which corresponds to the correction.

Deflection corrections are found on the lower part of the curve, and stress corrections on the top. These values apply equally to Interior and Exterior PlyForm.

Stresses, but not deflection values, for the other grades (EXT A-A and A-B) which are occasionally used in concrete forming could be increased.

Grade A-A because it has better veneers may be increased 16% and A-B 7%.

High Density Overlaid panels may also be increased for stress and stiffness because the surfaces are impervious to water preventing the plywood from becoming saturated when in use.

treating concrete forms

on the job

Reasonable care in using plywood forms will mean longer life and maximum re-use.

"Dope" all edges, saw cuts, and blemishes with lead and oil, aluminum primer, shellac or the like. Carefully prime cut edges.

Lower, do not drop, forms from high places to prevent damaging the working surfaces.

stripping

Careless stripping can destroy the best form materials.

Do not use metal bars or prys. Use wooden wedges. Plywood's resilience distributes the pull over a large area and minimizes damage. Double headed nails speed work and reduce form damage.

storing

Immediately after stripping, remove projecting nails, then clean and scrape the panels thoroughly with a wide, blunt blade.

Oil and stack panels on a dry, level surface protected from the weather. Use stickers to permit normal drying. DO NOT store under tarpaulin or plastic covers preventing the circulation of air.

planning

Advance planning and careful detailing will help gain a maximum re-use of the forms with little waste. Normally, forms wear out as the result of careless handling or having been cut into pieces too small to have further value. Whenever possible, prefabricate forms and standardize the tie holes with templates. For stud spacing, use jigs.

oiling

Unless otherwise specified, PlyForm panels are mill oiled and ready for the initial pour. After each use, clean and re-oil the panels with a good uniform coating of form oil such as a 100 pale. Use just enough to make the surface greasy to the touch.

High Density Overlaid fir plywood is not mill oiled, but its special surface needs no lubrication for the initial pour. Wiping with an oil rag before each use will, however, make stripping easier.

nailing

Use as small and as few a number of nails as possible in the forms. When nailing to studs use nothing larger than 5d in plywood up to ⅝″, 6d in ¾″ and in ¼″ liners, 2d.

suggested specifications

medium density overlaid fir plywood

All Medium Density Overlaid Fir plywood shall be of Exterior type with (one) or (both) faces of Medium Density overlay. Each panel shall carry the Douglas Fir Plywood Association edge brand EXT-DFPA.

Thickness and application details shall be as shown on the drawings.

plywood identification requirement

All fir plywood shall conform to the performance standards for its type in Commercial Standard CS45-55 for Douglas Fir Plywood. It shall further be attested to such conformance by means of DFPA grade-trademarks on each panel.

exterior type douglas fir plywood

All plywood permanently exposed to the weather shall be of Exterior type, manufactured in accordance with U. S. Commercial Standard CS45-55. Each panel shall carry the EXT-DFPA grade-trademark of the Douglas Fir Plywood Association as evidence of a waterproof glue-line.

douglas fir plywood

All plywood used for (specify e.g. subflooring, underlayment, roof sheathing, etc.) shall be of (specify type and grade) Douglas fir plywood, manufactured in accordance with U. S. Commercial Standard CS45-55. Each piece shall carry the (state grade) grade-trademark of the Douglas Fir Plywood Association.

Thickness and application details shall be shown on the drawings. Interior types shall have no edge or surface permanently exposed to the weather. Nailing shall be as indicated on engineering drawings or as recommended by the DFPA.

other data available

This catalog provides only basic information for the specifier and user of Douglas fir plywood. If additional information is required write Douglas Fir Plywood Association, 1119 "A" Street, Tacoma 2, Washington.

U. S. Commercial Standard CS 45-55

U. S. Commercial Standard CS 122-56
(for Western softwood plywood)

Technical Data Handbook

Construction Guide

Basic Facts About
Fir Plywood Diaphragms

DOUGLAS FIR PLYWOOD ASSOCIATION

1119 A Street - Tacoma 2, Washington - BRoadway 2-2283

Prepared by Douglas Fir Plywood Association, Tacoma, Washington
Form No. S-60

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